

# Decision Support System Development for Human Extravehicular Activity

Completed Technology Project (2013 - 2017)



## Project Introduction

The extension of human presence into deep space will depend on how successfully human planetary extravehicular activities (EVAs) are conducted without real-time mission control support. Current human planetary EVA technology and experience has been derived from the Apollo era exploration of the moon. With the advancement of cognitive engineering modeling, decision support tools (DST) development for planetary EVA has the potential to dramatically improve human exploration capabilities on extraterrestrial bodies. The work outlined in this proposal seeks to develop a DST capable of providing real-time decision making support in the absence of mission control support for astronauts in an extraterrestrial EVA environment. This research plans to implement a cognitive work analysis coupled with iterated field-test experiments in Earth analog-test sites to provide verification and validation capabilities to produce a DST for human planetary EVAs. The cognitive work analysis will provide the constraints needed to define the functional requirements of the DST. Once the requirements definition phase is complete, a prototype will then be built. Evaluation of the prototype will then be conducted in an Earth analog field-testing environment. Post processing of the testing will reveal design modifications which will then feedback to the redesign of the DST for further evaluation. This iterative process will enable performance enhancement of the DST function. The following outcomes are expected by this research project to further develop human- system performance in deep space to improve the decision making of astronauts in EVA and lessening their dependency of mission control. 1) Characterized list of mission control functional roles and constraints pertaining to support planetary EVAs. 2) Cognitive engineering based decision support tool for astronauts conducting deep space EVAs. 3) Working understanding of mission control operations in deep space EVAs in a non-real-time environment. As a result of this research, designers can infuse this DST into future habitat, vehicle, and suit concepts for human extraterrestrial exploration. As stated in the NASA's Draft of Modeling, Simulation, Information Technology and Processing for Technology Area 11 (TA-11), decision support tools are recognized as a game-changing technology for Human-System Performance Modeling. This proposed research has the opportunity to implement game changing technology in an area of NASA that has been unaltered for more than half a century.

## Anticipated Benefits

The following outcomes are expected by this research project to further develop human- system performance in deep space to improve the decision making of astronauts in EVA and lessening their dependency of mission control. 1) Characterized list of mission control functional roles and constraints pertaining to support planetary EVAs. 2) Cognitive engineering based decision support tool for astronauts conducting deep space EVAs. 3) Working understanding of mission control operations in deep space EVAs in a non-real-time environment. As a result of this research, designers can infuse this DST



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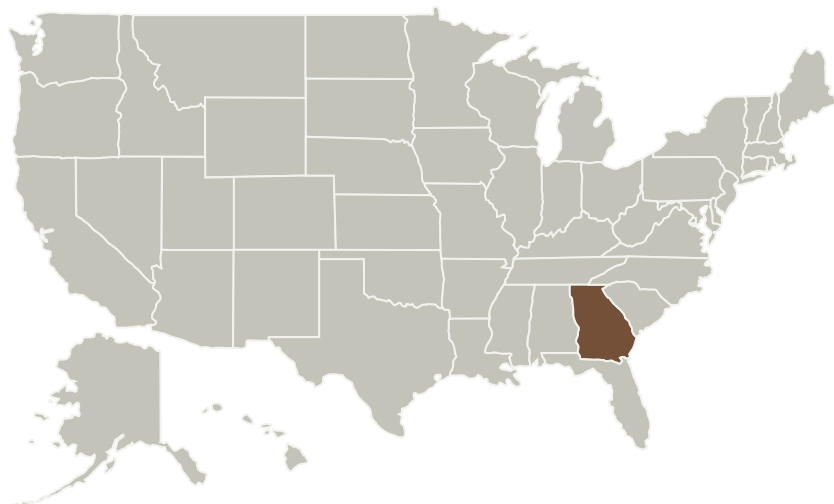
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into future habitat, vehicle, and suit concepts for human extraterrestrial exploration.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Georgia Institute of Technology-Main Campus(GA Tech)	Lead Organization	Academia	Atlanta, Georgia

## Primary U.S. Work Locations

Georgia

## Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Georgia Institute of Technology-Main Campus (GA Tech)

**Responsible Program:**

Space Technology Research Grants

## Project Management

**Program Director:**

Claudia M Meyer

**Program Manager:**

Hung D Nguyen

**Principal Investigator:**

Karen Feigh

**Co-Investigator:**

Matthew J Miller

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## Technology Maturity (TRL)

Start: **2**  
Current: **3**  
Estimated End: **3**



## Technology Areas

### Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.2 Extravehicular Activity Systems
    - └ TX06.2.3 Informatics and Decision Support Systems

## Target Destinations

The Moon, Mars